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The Dynamic Relationship between Real Estate Investment and Economic Growth: Evidence from Prefecture City Panel Data in China

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Abstract

This paper employed GMM for the first time to estimate the dynamic relevance between real estate investment and the economic growth based on the panel data of 284 Chinese Prefecture cities from 1994 to 2010. We find that the positive effect of real estate investment on economic growth is stronger in short term while in long term turn to be negative. Therefore housing investment is an important factor for short-term economy fluctuations and lead to downside risk in the long term. The effect of real estate investment also rely on the regional economy development and has periodic characteristics, which is stronger in the eastern region than the midwest region and the negative enduring impact is strengthened after 2004. Furthermore the government expenditure hinder the economy growth and cutting government expenditure and curbing the wind of extravagance by the new leadership in China is proved to be proper.

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Keywords: Real Estate Investment; Nonreal Estate Investment; Economic Growth;Generalized Method of Moments; Dynamic Panel Data

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1. Introduction

This century the rapid development of the real estate industry become distinctive feature of economy in China. The real estate investment enhanced from 3311.98 hundred million yuan in 2000 to 44,319.50 hundred million yuan in 2011 which is 13.38 times of 2010. The growth rate is higher than the 9.36 times of the total fixed asset investment. As an important part of household spending, real estate investment is important pillar of macroeconomy. Real estate funds maybe even outnumber commercial funding [1], and [2] found that the stock of real estate in America is close to annual average GDP. On the other hand, the rapid growth of real estate industry in China cause fears. The national real estate sales price rise from 2,112.00 yuan / square meter in 2000 to 5,357.10 yuan / square meter in 2011 with the average annual growth rate up to 12.8%. And the weight of the real estate investment in GDP increase from 3.34% in 2000 to 9.37% in 2011.The over-reliance on real estate would make the national economy deviate from the healthy, stable and sustainable development. It is significant and urgent to investigate whether the effect of real estate has changed and influenced by the different regions and period during the rapid development of real estate investment over 10 years.

Most literature in econometric method employed the Granger causality test to investigate the empirical relevance between the real estate investment and the economic growth [3,4,5,6]. [3] apply the unit root test based on provinces quarter panel data in China during 1999-2007 and confirm that there is stable bi-directional causality between the real estate investment and GDP both in the short term and long term, and region differences influenced the effect significantly.[4] also hold that bi-directional causality in short-term while in short term the real estate exert stronger impact on the economic growth.[5] make the generalized impulse response analysis and variance decomposition analysis and found significant unidirectional Granger causality from GDP to real estate investment .

This paper re-evaluated the empirical relevance between real estate investment and economic growth in China based on dynamic panel data from 284 cities between 1994-2010 in China. We update the time span timely and expand the individuals greatly. That would help increase the freedom degree and overcome the small sample bias and the endogenous problem in the econometric model. On the other hand it is important to capture the timely characteristic of real estate investment and derive more reliable empirical results. In addition, there is inertia and lag adjustment process in the economic growth, this paper established dynamic model proposed in [7] and empolyed GMM to characterize this feature.

2. The econometric model, data sources and variable declaration

This paper investigated the effect of the real estate investment on economic growth under the control variables. In addition to the menu cost, there is decision lag and inertia which make the actual economic growth deviate from the equilibrium in the short run. We include the lagged dependent variable in the independent variables in the model to capture this sluggish adjustment. Furthermore the dynamic model would help overcome the endogenous problem in the model and derive more reliable results. Taking the cities heterogeneity into account, this paper consider fixed effect and set model as equation(1).

$$
\begin{aligned}
& g_{it} = \alpha_0 + \alpha_1 g_{i(t-1)} + \beta_1 RV_{it} + \beta_2 RV_{i(t-1)} + \beta_3 NV_{it} + \beta_4 NV_{i(t-1)} + \beta_5 H_{it} + \beta_6 L_{it} + \beta_7 U_{it} + \beta_8 open_{it} \\
& + \beta_9 PD_{it} + \beta_{10} T_{it} + \beta_{11} G_{it} + \beta_{12} C_{it} + \eta_i + \lambda_t + \upsilon_{it} = \alpha_0 + \alpha_1 g_{i(t-1)} + \beta_1 RV_{it} + \beta_2 RV_{i(t-1)} + \beta_3 NV_{it} \qquad (1) \\
& + \beta_4 NV_{i(t-1)} + \sum_{j=5} \beta_j CV_{it} + \eta_i + \lambda_t + \upsilon_{it} = \alpha_0 + \alpha_1 g_{i(t-1)} + \beta X^*_{it} + \eta_i + \lambda_t + v_{it} = \delta' X_{it} + \eta_i + \lambda_t + v_{it}
\end{aligned}
$$

In which control variables CV_{it}=(H_{it} L_{it} U_{it} $open_{it}$ PD_{it} T_{it} G_{it} C_{it}), X_{it}*=(RV_{it} RV_{it-1} NV_{it} NV_{it-1} CV_{it}),

X_{it}=(g_{it} RV_{it} RV_{it-1} NV_{it} NV_{it-1} CV_{it}), i reprents city and t year.

Equation(1) investigate the effect of real estate investments on the economic growth under various control variables. The core independent variables include current and lagged real estate investment HV_{it} and HV_{it-1}, current and lagged non-real estate investment NV_{it}, NV_{it-1}.Control variables consist of human capital (H_{it}), labor force participation rate (L_{it}), the process of urbanization (U_{it}), trade openness ($open_{it}$), the actual tax burden (T_{it}),funds(F_{it}), population density (PD_{it}), government expenditures (G_{it}). η_i is the regional-specific effect and capture the impact of various unobservable specific factors of economic growth such as the climate, geographical characteristics. λ_t is the time-specific effect and describe the combined impact of improved production technology and the economic structure , prices and other factors. v_{it} is the random disturbance.

There are differences in industrial structure, the level of economic development in eastern and midwest region and is likely to influence the real estate demand and investment, therefore the effect on the economic growth. This paper established the region dummy and introduce the cross term of region dummy and the real estate investment in the basic model to investigate the region discrepancy impact on the effect of the real estate investment in equation(2). It signify the eastern region if $regdum = 1$ and midwest region when $regdum = 0$ .Therefore in equation(2) the effect of RVit and RVit-1 in eastern region is γ_0 and γ_2 respectively while $\gamma_0 + \gamma_1$ and $\gamma_2 + \gamma_3$ in the midwest regions.

$$g_{it} = \alpha_0 + \alpha_1 g_{i(t-1)} + \gamma_0 RV_{it} + \gamma_1 RV_{it} regdum + \gamma_2 RV_{i(t-1)} + \gamma_3 RV_{i(t-1)} regdum + \sum_{j=1} \beta_j CV_{it} + \eta_i + \lambda_t + \upsilon_{it} \quad (2)$$

The real estate market is highly prosperous after 2004 with the prices linearly upward and the demand and supply expanding greatly. We wonder whether there is inflection point at 2004 for the effect of real estate on the national economy. This paper establish the time dummy and introduced the cross term of the time dummy and the real estate investment in the basic model to investigate the periodic characteristics of real estate investment in equation(3). It represents 2004 and the years before 2004 if $tdum = 1$ while after 2004 if $tdum = 0$ .Therefore in equation (3) the effect of RV_{it} and RV_{it-1} after 2004 is θ_0 and θ_2 respectively while $\theta_0 + \theta_1$ and $\theta_2 + \theta_3$ before 2004.

$$g_{it} = \alpha_0 + \alpha_1 g_{i(t-1)} + \theta_0 RV_{it} + \theta_1 RV_{it} tdum + \theta_2 RV_{i(t-1)} + \theta_3 RV_{i(t-1)} tdum + \sum_{j=1} \beta_j CV_{it} + \eta_i + \lambda_t + \upsilon_{it} \quad (3)$$

This paper used the unbalanced panel data in which some variables are missing in some time. The data come from "China City Statistical Yearbook" while the exchange data from "China Statistical Yearbook". Limited by the availability of sample data, the samples begin from 1994 with the prefecture-level cities up to 284. The statistical software used in this paper is Stata12.0 and the procedure is xtabond2 introduced in [8].

The dependent variable is g_{it}, signified by the logarithm of GDP divided by the labor force. Explanatory variables include lagged dependent variables, the core argument and the set of control variables. The lagged dependent variable g_{it-1} take the form of first-order lag, and is expected to be positive for the inertia and the dynamic adjustment. Core independent variables include the following variables: ①current and lagged real estate investment HV_{it} and HV_{it-1}, signified by the logarithmic of urban real estate investment divided by employment. In the short term HV_{it} promote the employment and so on and stimulate the national economy while in the long-term it is unclear ②current and lagged non-real estate investment NV_{it} and NV_{it-1}, represented by the total investment in fixed assets minus the real estate investment, in the logarithmic and per capita. The effect of non-real estate investment is similar to the real estate investment.

From the existing literature especially the macroeconomic theory, the following variables composite the set of control variables: ①The labor force participation rate (L_{it},%), measured by the employment divided by the

total population and expected to be positive for providing the national economy with labor. ②Human capital (H_{it},%) is the specific weight of the students of colleges and middle schools in the total students and expected to be positive.③The level of the urbanization (U_{it},%) is represented by the non-agricultural population divided by the total population. The national economy benefit from the urbanization process generally.④Trade openness（$open_{it}$, %）, signified by the trade volume divided by total output values. Trade liberalization promote the economic performance in general and is expected to be positive. ⑤Actual tax level((T_{it}, %) is the percentage of the revenue financial accounts in local GDP. The tax come from the people and benefit the people and the symbol is not clear. ⑥Funds (C_{it}, %) is represented by the proportion of the year-end balance of loans in industrial output value and we anticipate it promote economic growth. ⑦Population density (PD_{it}, persons/sq km) is denoted by the total urban population divided by the land area.⑧Government expenditure (G_{it},%)is the proportion of urban local government budget expenditure in the total output value. Similar to the actual tax levels, the symbol is not clear.

3. Empirical results and Analysis

We adopt the SYS-GMM improved from DIF-GMM .In SYS-GMM it is necessary to classify the variables into endogenous variables, strictly exogenous variables or non-strict exogenous variables and adopt the relevant procedures. Given the fact that there are endogenous problem more or less with the control variables we take these control variables as non-strict exogenous variables for caution. The result is shown in Table 1 and the coefficients retained three decimal places.

Table 1. The SYS-GMM empirical result of the effect of the real-estate investment on economic growth and the relevant region discrepancy and periodic characteristic

Exp var	Equation(1)	Equation(2)	Equation(3)
$g_{i(t-1)}$	0.672(0.002)	0.687 (0.003)	0.673(0.002)
RV_{it}	0.096(0.001)	0.069(0.001)	0.095(0.001)
$RV_{i(t-1)}$	-0.033(0.001)	-0.008(0.001)	-0.033(0.001)
$RV*redum_{it}$		0.080(0.002)	
$RV*redum_{it-1}$		-0.0868(0.002)	
$RV*tum_{it}$			0.004(0.0003)
$RV*tum_{it-1}$			0.004(0.0003)
NV_{it}	0.403(0.003)	0.372(0.003)	0.407(0.003)
NV_{it-1}	-0.293(0.003)	-0.247(0.002)	-0.296(0.003)
H_{it}	-0.089(0.003)	-0.068(0.003)	-0.088(0.002)
L_{it}	-0.324(0.006)	-0.370(0.011)	-0.324(0.007)
$urbanization_{it}$	0.071(0.006)	0.110(0.007)	0.069(0.005)
$open_{it}$	0.093(0.001)	0.095(0.002)	0.092(0.001)
PD_{it}	1.51e-06(1.80e-06)	0.000(1.93e-06)	1.93e-06(1.79e-06)
T_{it}	0.335(0.030)	0.301(0.034)	0.355(0.034)
G_{it}	-0.476(0.003)	-0.503(0.003)	-0.482(0.004)
C_{it}	-0.0296(0.001)	-0.026(0.001)	-0.029(0.001)

constant	2.212(0.015)	1.918(0.025)	2.195(0.015)
AR(1)	0.021	0.012	0.020
AR(2)	0.874	0.763	0.902
Hansen	1.000	1.000	0.000
obs	1028	1028	1.000

In table 1, The value in the brackets are the robust standard errors of the estimators .AR (1) test whether there is first-order serial correlation concerning the error in differential equation while AR (2) test whether the second-order serial correlation, and the null hypothesis is that there is no serial correlation. Hansen statistic test whether the over-identification restrictions are valid, the null hypothesis is that the over-identification restrictions is valid. Table1 report the p-value of the test statistic.

GMM estimation requires second-order serial irrelevance in the residuals of the difference equation while first-order serial irrelevance AR(1) is unnecessary. [7] constructed AR (2) statistic to test second-order serial correlation. With respect to the effectiveness of the over-identification of moment condition, this paper carry out Hansen test to test the overall effectiveness of the instrument variable. The P-value of AR (1), AR (2) and Hansen test is reported below Table1. All estimators are significant at the level of 0.1% , including the lagged economic growth rate g_{it-1} and the cross-term of $RVregdum_{it}$, $RVregdum_{it-1}$, $RVtdum_{it}$,$RVtdum_{it-1}$,which confirms the significant presence of the dynamic process of the economy growth and the region and period discrepancy on the effect of real estate investment. All P values of AR(2) are above 75%, we can not refuse the assumptions of second-order serial irrelevance. AR (1) failed to pass while it is unnecessary .Finally, the P-values of Hansen statistics are 100%, the instrument variables are effective. The model in this paper meets the prerequisite requirements of GMM, the empirical result is significant and reliable.

The economic growth rate $g_{i\,(t-1)}$ is positive and less than 1 in line with the economic theory. Concerning the core variables, the coefficient of real estate investment RV_{it} and RV_{it-1} is 0.096 and -0.033. That imply in national level the effect of real estate investment in stimulating economic growth is stronger in short-run while turn to hamper the national economy in long-run, which maybe due to the real estate investment crowd out the other investment and consumption and finally threaten the national economy. Therefore the real estate investment is significant factor for short-term fluctuations of the national economy in China. With respect to the region discrepancy, the empirical results of equation (2) showed that effect of the real estate investment HV_{it} and HV_{it-1} in eastern region are 0.15and-0.17 while in the midwest region 0.07 and -0.008 respectively. Therefore the effect of real estate investment in promoting economic growth in the eastern region is stronger than in the midwest region in the short run, and the negative impact exerted on national economy in the long-turn is stronger in eastern region but weaker than the national level. Respecting the period characteristic, the effect of HV_{it} and HV_{it-1} before 2004 is 0.10 and -0.029 while 0.10 and -0.033 after 2004. Although the short-turn role in promoting economy do not change significantly, the negative effects in the long-term is stronger after 2004, indicating the crowding-out effect of the real estate investment is strengthened and the risk of real estate bubble rise after 2004. The effect of non-real estate investment NV_{it} and NV_{it-1} is 0.404 and -0.29 respectively and outnumber the role of estate investment. It is important to control the reasonable scale of the real investment and non-real estate investment. Furthermore the long-term effect of investment in promoting the economic growth decrease progressively maybe for the reason that the Chinese government over-rely on the investment in the development strategy, such as the four trillion yuan investment issued in the financial crisis in 2008. Comparatively the domestic consumption and the trade liberalization become more effective in promoting national economy. The impact of the human capital H_{it} and labor force participation rates L_{it} is not obvious. Maybe the human capital and labor force are still not sufficient to support the economic growth and it is significant to increase the investment in education, job skills training and so on. The national economy benefit from the urbanization process U_{it}, freer trade regime $open_{it}$, the population density PD_{it} and actual tax burden T_{it} .That imply that the benefit of the tax dominate the burden brought to the people. The government

expenditure G_{it} weakened the economic growth and it is urgent to cut the government unreasonable expenses and use the expenditure more rationally. The new Chinese leadership core to Jinping Xi advocate austerity, curb the wind of extravagance and cut down the government expenditure. This paper found the empirical evidence for this policy.

4. Conclusions

This paper employed GMM based on the dynamic panel data of 284 prefecture cities in China during 1994-2010 to evaluate the long-term and short-term effect, the region discrepancy and periodic characteristic of the real estate on the economic growth .We find that in short run the real estate investment stimulate the economic while hamper the economic growth in the long-term. The unbalanced levels of economic development in eastern and midwest region in China influences the effect of the real estate. Both of the short-run effect of the real estate in promoting economic growth and the long-run negative effect in the eastern region are stronger than in the midwest region. It is important to control the reasonable size and growth rate of the real estate investment and take regional real estate regulatory policies. The situation is similar in the non-real estate investment and the national economy in China benefit from the freer trade regime. The Pessimistic evidence of the investment is closely related with the development strategy over-reliance on investment in China such as the four trillion yuan investment issued in the financial crisis in 2008.It is necessary to shift the economic growth mode to rely on domestic consumption and trade liberalization process and abandon the over-investment, which confirms the appropriate approach of Keqiang Li government. Furthermore the national economy in China benefit from the urbanization process while the human capital and labor force participation is insufficient. Especially the government expenditure hamper the national economy while the actual tax burden play a positive role, which confirm the importance of curbing the wind of extravagance and cutting down the government expenditure by the new Chinese leadership core to Jinping Xi.

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